Harnessing Nature's Diversity

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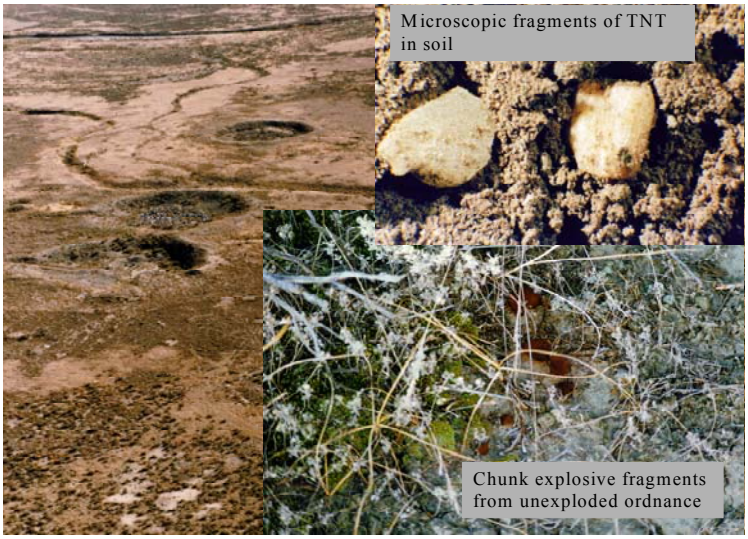
Bioremediation of Explosives

A team of scientists and engineers at the INEEL has developed effective systems for remediating explosives-contaminated soils and wastewater.

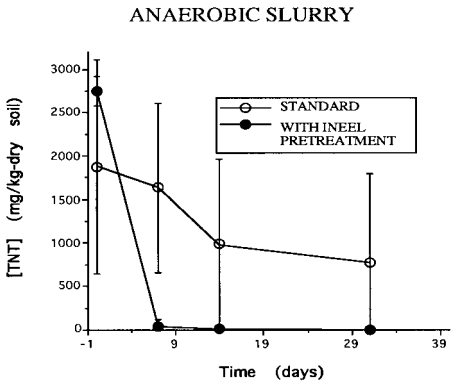


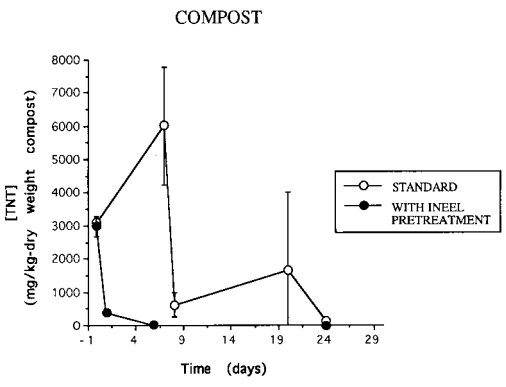
Explosives in Soil

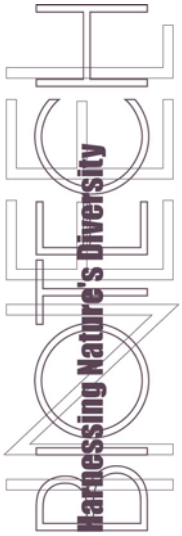
A number of biotreatment strategies and systems for remediating explosives-contaminated soils has previously been proven effective on screened soils or soils devoid of sizeable explosive particles. In contrast, solid explosive chunks within a soil matrix such as those present at the INEEL constitute a major problem in the bioremediation of a contaminated site. Complete biodegradation of a solid chunk of TNT in soil is difficult to achieve because little of the contaminant is available to the microorganisms that degrade it (TNT is soluble in water at 100 to 200 µg/mL). The INEEL has developed a pretreatment that renders the soil/chunk explosive matrix amenable to conventional biotreatment technologies. We are currently refining the systems necessary to integrate the physical/chemical pretreatment with the appropriate modifications of proven biotreatment technologies such as composts or soil bioslurries.

Explosives in Aqueous Waste Streams

The INEEL has developed an immobilized cell bioreactor system capable of degrading 2,4,6-trinitrophenol (picric acid) in an aqueous waste stream.







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The reactor uses a degradation pathway in which picric acid (as picrate) is the main carbon and energy source. This system degrades picrate completely, as evidenced by stoichiometric nitrate release. After a series of reactor optimizations, the process handles up to 4,000 µg/mL picrate with a residence time of 1.5 days.

The INEEL has a multidisciplinary technical staff and facilities that can provide RCRA and CERCLA treatability studies for explosives remediation and environmental restoration, and that can design novel systems to address site-specific complexities.

Selected Publications/Presentations

C. W. Radtke, D. Gianotto, and F. F. Roberto, "Effects of Particulate Explosives on Estimating Contamination at a Historical Explosives Testing Area," *Chemosphere,* Vol. 46, 2002, pp 3–9.

C. W. Radtke, R. M. Lehman, and F. F. Roberto, "Increased Biotransformation Efficiency of Chunk-TNT-Contaminated Soil Using Acetone Pretreatments," *Bioremediation Journal*, Vol. 4, No. 1, 2000, pp. 57–67.

C. W. Radtke et al., "Method for the Decontamination of Soil Containing Solid Organic Explosives Therein," U. S. Patent 6,051,420, April 18, 2000.